NUCLEAR INSTRUMENTS and SYSTEMS

INSTRUCTION MANUAL

FOR

REGULATED HIGH VOLTAGE POWER SUPPLY

Model N-4035

INSTRUMENT
CENTER

Hamner

HAMNER ELECTRONICS CO., INC., P.O. Box 531, Princeton, New Jersey • 737-3400

INSTRUCTION MANUAL

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Model N-4035

9/63

HAMNER ELECTRONICS CO., INC.

P. O. Box 531
Princeton, New Jersey

C A U T I O N

THE VOLTAGES AND CURRENTS SUPPLIED BY THE N-4035 CAN BE FATAL. TAKE ALL PRECAUTIONS TO PREVENT COMING IN CONTACT WITH THE OUTPUT. THE TOP AND BOTTOM SHIELDS ARE PROVIDED WITH A.C. INTERLOCKS. REMOVING EITHER OF THESE SHIELDS WILL TURN "OFF" THE A.C. POWER FOR YOUR PROTECTION.

CAUTION SHOULD BE EXERCISED WHILE WORKING ON THIS UNIT.

REGULATED HIGH VOLTAGE POWER SUPPLY

MODEL N-4035

INTRODUCTION

The Model N-4035 Power Supply was developed for applications requiring very high voltage stability, low ripple and sufficient current output for operating several photomultiplier tubes in parallel. The circuit is built around a reference made up of a string of the ultra stable-type 85A2 gas discharge reference tubes. These tubes have a voltage variation of less than 10 PPM. per hour for their first 1000 hours and less than 2 PPM. per hour thereafter. The relatively large temperature coefficient of 40 PPM. per degree C of these tubes will be the factor determining the voltage stability.

SPECIFICATIONS

Power:	115V., 50-60 cy., about 200 W.
Output Voltage:	750-3550 volts, continuously variable.
Polarity:	Both Outputs floating; either side may be grounded.
Line Regulation:	0.005%, 105 to 125 volts.
Load Regulation:	0.005%, 0-25 ma.
Noise & Ripple:	Less than 1 mv. rms.

Output Impedance:	Equivalent to 7 ohms series resistor shunted by 2 mfd Capacitor.
Output Connections:	UG560/U on back panel for each polarity. Shorting type cover cap and chain is provided on back panel for grounding either side of the output.
Resolution:	Continuously variable thru Coarse and Fine controls with 1 volt resolution.
Long Term Stability:	0.05% per hour.
Tube Complement:	2 - 6BG6, 2 - 12AX7, 7 - 85A2, 1 - 12AT7, 1 - 4HTF4 Ballast.
Weight:	37 pounds.

FRONT PANEL INDICATORS AND CONTROLS

Power "ON";	Connects AC to primary of filament transformer only. Power "ON" is indicated by Green Jewel Light above switch.
High Voltage "ON":	Connects AC to primary of power transformers which provide the necessary voltage for the high voltage full-wave doubler and the half-wave rectified screen voltage for the series regulator.

The high voltage "ON" is indicated by the Red Jewel Light above the switch.

Coarse Voltage Control: Eleven-position switch that covers the range 750-3250 volts in 250 volt steps.

Fine Voltage Control: Continuous adjustment of 0-300 volts graduated in 1 volt steps through 3 turns of the Dial. The total output voltage is the sum of the Coarse and Fine Voltage Control settings. The Fine Control may be locked by pulling down the lever on the side of the Dial.

OPERATING PROCEDURE

1. Turn High Voltage switch "OFF".
2. Connect Load to Output at rear of unit. If the supply is to be floated, connect the cables to their respective Positive and Negative outputs. If, however, it is desirable to ground either the positive or negative side, do so by screwing on the grounding cap provided which is hanging on a chain between the two outputs.
3. Set output voltage COARSE and FINE Controls.

4. Connect the Power cord into a source of 115 v AC, 60-cycle power.
5. Turn Power switch "ON" and allow instrument to warm up for 2 minutes.
6. Turn High Voltage switch "ON".

NOTE: After initial 2-minute warm-up period, the HIGH VOLTAGE may be turned "ON" or "OFF" at will. Unless monitoring of the Output voltage is done with a calibration standard of at least 0.5% accuracy which has been recently inspected, any small measured errors in Output voltage should be disregarded.

PRINCIPLE OF OPERATION

The N-4035 utilizes Series Regulation as a means of obtaining constant output voltage.

The unregulated high voltage is obtained through the rectification of the stepped-up (T1) 60 cps. line voltage by a silicon full-wave Voltage Doubler (SR1 thru SR24).

The Series Regulator (V1, V2) utilizes the pentode with a separate screen supply. This type of design provides a cathode follower whose output is little affected by large ripple and/or plate voltage excursions.

The reference voltage is made up of a string of seven high stability gas reference tubes in series. This reference voltage of approximately 585 volts is supplied with constant

current from the constant current regulator. A styrofoam cover encloses these reference tubes to minimize fluctuations caused by changing temperatures.

The Regulator Stage (V5) serves several purposes. It supplies the amplifier and reference tubes with a constant current in addition to reducing noise and ripple in the gas tube reference string by degeneration through C9.

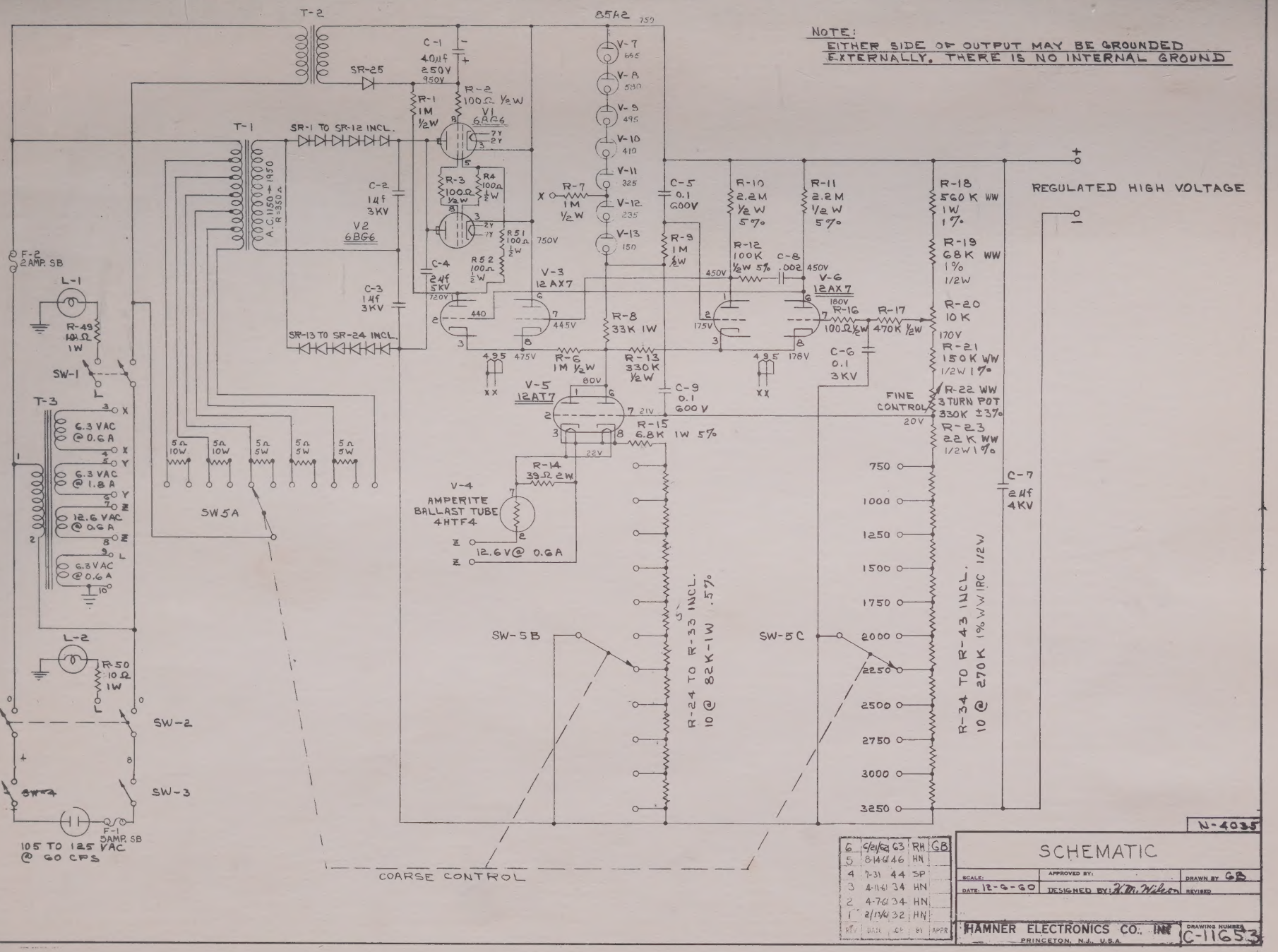
A portion of the output voltage is obtained from the wire-wound resistance divider string (R18 thru R23, R34 thru R43) and compared with the reference voltage to form an error signal in the difference Amplifier (V6, V3).

The error signal is amplified by about 6,000 times in the amplifier before it is applied to the series regulator. This high gain is both AC and DC. There is no fall off in gain at low frequencies because direct coupling is used.

SCHEMATIC REF. NO.	DESCRIPTION	MANUFACTURER	PART NO.	QT.
	CAPACITORS			
C1	40 MFD 250V, Electrolytic	Sprague	TVA-1511	1
C2,3	1 MFD 3000V, Plastic Film	Plastic Cap.	OE30-105	2
C4	2 MFD 5000V, Plastic Film	Plastic Cap.	OE50-205	1
C5,9	0.1 MFD 600V, Mylar	Elmenco	6DP 4-104	2
C6	0.1 MFD 3000V, Glassmike	Plastic Cap.	OF30-104	1
C7	2 MFD 4000V, Plastic Film	Plastic Cap.	OE40-205	1
C8	0.002 MFD 600V, Ceramic Disc.	R. M. C.	Z5U	1
	RESISTORS			
R1,6,7	1 Meg ½W 5% Carbon	Allen Bradley	EB-1055	3
R2,3,4, R5,16	100 Ohm ½W 5% Carbon	Allen Bradley	EB-1015	5
R8	33K 1W 5% Carbon	Allen Bradley	GB-3335	1
R9	1 Meg ½W 5% Carbon	Allen Bradley	EB-1045	1
R10,11	2.2 Meg ½W 5% Carbon	Allen Bradley	EB-2255	2
R12	180K ½W 5% Carbon	Allen Bradley	EB-1845	1
R13	330K ½W 5% Carbon	Allen Bradley	EB-3345	1
R14	39 Ohm 2W 5% Carbon	Allen Bradley	HB-3905	1
R15	6.8K 1W 5% Carbon	Allen Bradley	GB-6825	1
R17	470K ½W 5% Carbon	Allen Bradley	EB-4745	1
R18	560K 1W 1% Wirewound	I. R. C.	WW 4 J	1
R19	68K ½W 1% Wirewound	I. R. C.	WW 3 J	1
R20	10K 1/10W Miniature Pot.	Centralab	B16-115	1

SCHEMATIC REF. NO.	DESCRIPTION	MANUFACTURER	PART NO.	QT.
R21	150K ½W 1% Wirewound	I. R. C.	WW 3 J	1
R22	330K 3-Turn Potentiometer	Spectrol	830	1
R23	22K ½W 1% Wirewound	I. R. C.	WW 3 J	1
R24 thru R33	82K 1W 5% Carbon	Allen Bradley	GB-8235	10
R34 thru R43	270K ½W 1% Wirewound	I. R. C.	WW 3 J	10
R44,45	5 Ohm 10W Wirewound	Truohm		2
R46,47, R48	5 Ohm 5W Wirewound	Truohm		3
R49,50	10 Ohm 1W 5% Carbon	Allen Bradley		2
	VACUUM TUBES			
V1,2	6BG6	R. C. A.		2
V3,6	12AX7/ECC83	Amperex (only)		2
V4	4HTF4 Ballast	Amperite		1
V5	12AT7	Tung Sol		1
V7 thru V13	85A2	Amperex		7
	RECTIFIERS			
SR1 thru SR25	500 ma. 400 PIV, Silicon	Semicon	S-16	25
	TRANSFORMERS			
T1	Power Transformer, H. V.	Cycle Trans.	H-306	1
T2	Isolation Transformer	Cycle Trans.	H-275A	1

SCHEMATIC REF. NO.	DESCRIPTION	MANUFACTURER	PART NO.	QT.
T3	Filament Transformer	Cycle Trans.	H-276A	1
T4	Pilot Light Transformer	Triad Trans.	F13X	1
	SWITCHES			
SW1,2	AC Power Switch	Carling	ST 22K	2
SW3,4	Interlock Switch	Switchette	CR1070C146	2
SW5	H. V. Coarse Switch	Hamner	B-11295	1
	MISCELLANEOUS			
	Motor Base	Amphenol	160-3	1
	H.V. Output Connector	Amphenol	~~UG/560U~~	2
F1	Fuse, 1 amp.		3 AG	1
F2	Fuse, 2 amp.		3 AG	1
	Pilot Light Bulbs	Gen. Electric	328	2
	Interlock Switches	Electro-Snap	SL 1-4	2



REV	DATE	BY	APPR
6	6/21/63	RH	GB
5	8-14-62	HN	
4	7-31 44	SP	
3	4-11-61	34	HN
2	4-7-61	34	HN
1	2/13/61	32	HN

N-4035

SCHEMATIC

SCALE: | APPROVED BY: | DRAWN BY GB

DATE: 12-6-60 | DESIGNED BY: W. M. Wilson | REVISED

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